Sustainability in the Logistics Sector Beyond Firm-Level Strategies: Macroeconomic Constraints in Central and Eastern Europe

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***Abstract*— Sustainable development is currently a key challenge for the logistics sector. This sector is an essential part of economic activity, supporting production and distribution processes and contributing to environmental pressures. In the literature, sustainability in logistics is analysed in terms of decisions made by company managers, with the dominant context being innovation, regulation, and financial conditions. This study aims to investigate sustainability in logistics as a process that goes beyond corporate strategy and is deeply embedded in the macroeconomic context of development in Central and Eastern Europe. The study contributes to the economic literature by conceptualising sustainable logistics as a context-dependent and structurally constrained process. The article is qualitative and conceptual. The study utilises literature analysis and desk research, supplemented by the interpretive application of PESTEL, SWOT, and TOWS tools. These tools were used to organise key macroeconomic conditions and identify the central tensions affecting the implementation of sustainability activities in logistics. The analysis indicates a discrepancy between growing regulatory and market requirements and logistics companies' ability to achieve long-term transformation amid macroeconomic instability. The article's conclusions emphasise the need to consider the macroeconomic context when assessing the realistic possibilities for sustainable development of the logistics sector in the region.**

Keywords— sustainability in logistics, macroeconomic constraints, Central and Eastern Europe, qualitative analysis, PESTEL–SWOT–TOWS.

I. INTRODUCTION

Sustainable development has become a central issue in debates on socio-economic development, amid an upward trend in macroeconomic instability and geopolitical uncertainty (Zhao et al., 2025; Bellos et al., 2025). This has gained special importance in the logistics sector, which plays a major role in the economy and also generates significant environmental problems (Gružauskas et al., 2018; Bal & Vleugel, 2023). In the literature, sustainability in logistics is most often analysed from the perspective of managerial strategies, the implementation of green innovations, legal regulations regarding environmental protection, and sustainable financial conditions (Yoo, 2025; Bálint, 2025). Researchers focus on identifying the determinants of sustainable logistics.

At the same time, relatively less attention is paid to the broader macroeconomic context in which logistics companies operate (Gniadkowska-Szymańska et al., 2025; Bartosiewicz et al., 2025). A fascinating region in Europe that has so far been relatively poorly described in this regard is Central and Eastern Europe (CEE). This region is characterised by varying levels of economic and logistics development, and a relatively underdeveloped transport infrastructure (Peredy & Lakatos, 2025). These factors may impact the achievement of sustainable development goals. Moreover, the region's immense importance should be emphasised, as it connects northern and southern Europe, as well as western Europe with Asia (Chen et al., 2025).

This article aims to present sustainable development in logistics as a process that transcends corporate strategies and is deeply embedded in the macroeconomic context of CEE development. The novelty of this study lies solely in its conceptual approach to sustainability in logistics, including the influence of macroeconomic conditions. In the article, the key tensions are revealed, related to the interplay between the regulatory environment and logistics firms' capabilities in driving the transformation process.

This study contributes to the economic literature by conceptualising sustainability in logistics as a macroeconomically constrained process rather than a firm-level strategic choice, with particular relevance to Central and

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Eastern Europe.

The paper is qualitative and conceptual. The study utilises literature analysis and desk research, supplemented by PESTEL, SWOT, and TOWS analyses. These tools were used to organise the key macroeconomic conditions for the logistics sector and identify tensions affecting the implementation of sustainability initiatives.

The article's structure is as follows. The first part presents the theoretical foundations of sustainability analysis in logistics. This is followed by a presentation of the macroeconomic context of the sector's operation in Central and Eastern Europe. The next part includes an interpretive analysis using PESTEL, SWOT, and TOWS tools. The article concludes with a discussion of the results and conclusions.

II. THEORETICAL BACKGROUND

In recent years, sustainable development has become an important reference point in analyses of enterprise activity (Yan et al., 2025; Mu et al., 2025). Its essence lies in the simultaneous consideration of economic, social, and environmental goals, with a long-term balance among them (Bartosiewicz et al., 2025; Gniadkowska-Szymańska et al., 2025). The literature emphasises that an enterprise's sustainability is not limited only to improving financial performance but also encompasses responsible resource management, strengthening relationships with stakeholders over time, and minimising the environmental impacts generated by economic activity (Toborek-Mazur & Partacz, 2024; Alkandi, 2025; Adamczyk, 2025).

In this context, logistics is vital, as it constitutes an integral element of production and distribution processes, as well as the flow of information and capital (Čamaj et al., 2025). Logistics processes influence both the economic efficiency of enterprises and the scale of environmental pressures. The negative ecological impact of logistics is manifested in high energy consumption, pollution, and waste (Barut et al., 2023; Parvez et al., 2026). Therefore, logistics is one of the most critical areas for implementing sustainable development principles at the microeconomic level.

To date, research on sustainability in logistics has focused primarily on the enterprise or supply chain perspective (Lazar et al., 2021; Rohit et al., 2025). Such analyses focus on logistics process management, technological innovation, supply chain optimisation, and the adjustment of operations to legal requirements and stakeholder expectations (Anwar et al., 2025; Memari et al., 2025). In this approach, sustainable development is most often treated as the result of conscious strategic decisions made by managers, who rely on specific financial and organisational resources (Qin et al., 2026).

At the same time, the literature increasingly indicates that external factors strongly influence companies' implementation of the sustainable development concept (Comporek et al., 2022; Misztal et al., 2024; Bartosiewicz et al., 2026). The most important of these include the level of socioeconomic development, macroeconomic stability, public policy, access to financing, and institutional conditions (Khalil et al., 2025; Kowalska & Misztal, 2025). Exogenous factors create the framework within which companies make decisions regarding investments, innovations, and pro-environmental activities.

This is particularly important in Central and Eastern European countries, which are characterised by greater sensitivity to economic fluctuations and investment constraints (Geise & Szczepaniak, 2025; Nowak et al., 2025). Logistics companies might be constrained in their long-term implementation of sustainable strategies, despite their declared strategy and management's so-called intentions (Mütze et al., 2022). Omitting this aspect creates a narrow view of sustainability, treating it as a company-specific variable.

Therefore, it is justified to expand sustainability analysis in logistics to include a qualitative macroeconomic perspective that captures the interdependencies between the economic environment and the real opportunities for enterprise transformation. This approach allows for a better understanding of the tensions between growing regulatory and market requirements and the logistics sector's ability to implement them in the specific conditions of Central and Eastern Europe.

III. MATERIALS AND METHODS

The article is qualitative and conceptual, based on a literature review and desk research. The analyses used European Union and national reports as well as scientific publications (Bal & Vleugel, 2023; Bartosiewicz et al., 2025; Gniadkowska-Szymańska et al., 2025). This research approach allows for a synthetic analysis of sustainability in logistics within a macroeconomic context, without limiting the analysis to individual-company perspectives.

The central research hypothesis is formulated as follows: "In CEE, logistics sustainability is driven more by macroeconomic and geopolitical constraints than by firm-level strategy. aints rather than by firm strategic choices in Central and Eastern Europe" (Bellos et al., 2025; Chen et al., 2025; Zhao et al., 2025; Bartosiewicz et al., 2025).

RQ1: Which macroeconomic and geopolitical conditions shape logistics sustainability in CEE?

RQ2: Which sector-specific factors in CEE influence the capacity to implement sustainability initiatives?

RQ3: Which tensions emerge between sustainability demands and implementation capacity under current macroeconomic and geopolitical pressures?

The analysis utilized PESTEL, SWOT, and TOWS tools, applied interpretively (Peredy & Lakatos, 2025; Yoo, 2025; Yan et al., 2025). PESTEL was used to identify key macroeconomic, institutional, and regulatory factors utilized in the logistics sector in Central and Eastern European countries (Bal & Vleugel, 2023; Adamczyk, 2025). The SWOT analysis was applied solely to identify structural strengths, weaknesses, opportunities, and threats linked to sustainability in logistics, and did not serve as a basis for strategic conclusions (Peredy & Lakatos, 2025). TOWS was applied as an analytical framework to identify central tensions between macroeconomic conditions and the logistics sector's capacity to implement sustainable

solutions (Bellos et al., 2025; Zhao et al., 2025).

The tools used provide an analytical framework to support the interpretation of the research problem, but do not function as traditional strategic planning methods. This approach enables the organization of complex macroeconomic conditions and a better understanding of the constraints and tensions that accompany the implementation of organizational goals in the logistics sector of Central and Eastern Europe (Gniadkowska-Szymańska et al., 2025; Bartosiewicz et al., 2025).

IV. RESULTS

The results of the PESTEL analysis indicate a significant recent shift in the operating conditions of the logistics sector in Central and Eastern European countries toward greater uncertainty and an increasing importance of external factors. The prevailing conditions indicate that a complex and multifaceted context currently shapes sustainability in logistics. Requirements for security, resilience and economic competitiveness increasingly constrain environmental goals.

An overview of macroeconomic and geopolitical factors is presented in Table 1, showing that the environment's impact on the logistics sector is cumulative. Regulatory and environmental pressures are increasing, alongside investment constraints and varying levels of infrastructure and technology development in the region. As a result, the conditions for implementing sustainable development initiatives are not uniform, and their feasibility depends mainly on the institutional and economic context of individual countries.

At the same time, the results indicate that the current geopolitical situation is strengthening the importance of short-term stabilisation goals, which influences the hierarchy of priorities in the logistics sector. In such conditions, sustainability activities are implemented within the constraints of cost pressures, operational risks and regulatory requirements, which creates specific tensions between transformational ambitions and the sector's adaptive capacity.

TABLE 1. PESTEL ANALYSIS OF MACROECONOMIC AND GEOPOLITICAL CONTEXTS SHAPING SUSTAINABILITY IN THE LOGISTICS SECTOR IN CEE

Dimension	Key macroeconomic and geopolitical contexts	Implications for sustainability in logistics in CEE
Political	EU transport and climate policies increasingly interact with geopolitical developments, particularly following Russia's war against Ukraine. Policy priorities now combine sustainability objectives with concerns related to energy security, supply chain resilience, and infrastructure protection.	For logistics in CEE, sustainability initiatives are embedded in a broader security-oriented policy framework. This reduces the scope for purely voluntary sustainability strategies and strengthens the role of externally imposed constraints.
Economic	Logistics companies operate in an environment of macroeconomic uncertainty, cost pressure, and cautious investment behaviour. Although inflationary pressures have eased, investment decisions remain sensitive to financing conditions and energy price volatility.	In CEE economies, limited access to capital and higher sensitivity to cost shocks may slow down capital-intensive sustainability investments, widening the gap between sustainability ambitions and economic feasibility.
Social	Societal awareness of environmental and health impacts of transport is increasing across the EU, translating into growing expectations regarding transparency, environmental responsibility, and service quality. These expectations remain uneven across regions.	Logistics firms in CEE face rising but heterogeneous stakeholder pressure, which results in differentiated market expectations and uneven adoption of sustainability-related practices.
Technological	The transition toward sustainable logistics depends on access to low-emission technologies, digitalisation, and infrastructure modernisation. At the EU level, innovation and productivity are increasingly framed as conditions for maintaining global competitiveness.	Structural disparities in technological readiness and infrastructure quality across CEE countries limit the uniform implementation of sustainable logistics solutions and reinforce asymmetries within the sector.
Environmental	Transport continues to be the largest source of greenhouse gas emissions in the EU, with recent assessments indicating limited progress in emission reduction. Environmental pressures therefore intensify regulatory and societal demands for decarbonisation.	The logistics sector in CEE is subject to growing environmental pressure, while constrained investment capacity increases the risk of an implementation gap between environmental targets and actual performance.
Legal	EU regulatory frameworks related to emissions, sustainability reporting, and environmental standards are expanding and becoming more complex. At the same time, regulatory measures increasingly address transport security and resilience.	For logistics companies in CEE, compliance requirements raise operational and financial burdens, influencing both the pace and scope of sustainability-oriented adjustments and investments.

Source: own elaboration based on official reports and documents of the European Commission, European Environment Agency, European Central Bank, UNCTAD, and European External Action Service.

Building on the PESTEL analysis results, the next step was to identify key structural features of the logistics sector in CEE. For this purpose, a SWOT analysis was used as a descriptive tool to organise the sector's internal strengths, weaknesses, opportunities, and threats arising from macroeconomic and geopolitical environments.

The SWOT analysis was not designed to deduce strategic recommendations. Its task was to deliver a structured overview of the conditions under which sustainability initiatives in logistics are currently being set. By linking internal sector characteristics with external pressures, the analysis points to development potential as well as persistent constraints affecting

the sustainability in Central and Eastern Europe.

The SWOT analysis indicates that the logistics sector in Central and Eastern Europe combines development potential with persistent constraints (Table 2). The CEE region's logistics market faced challenges connected to energy security, infrastructure, and macroeconomic conditions, which serve as important constraints on progress toward sustainability. The existing issues in the region's logistics market have created permanent concerns about sustainability, on the one hand, and its adaptive capacity in the face of geopolitical, legislative, and economic factors, on the other.

TABLE 2. SWOT ANALYSIS OF LOGISTICS SUSTAINABILITY IN CEE IN A MACROECONOMIC–GEOPOLITICAL CONTEXT

Strengths	Weaknesses
Strategic location and corridor role of CEE within the EU, supporting regional connectivity and trade flows, which strengthens the sector's systemic importance and bargaining position in supply chain redesign.	Investment constraints and cost sensitivity, which limit the feasibility of capital-intensive sustainability upgrades (fleet renewal, low-emission technologies, infrastructure).
Operational flexibility and adaptive capabilities built through repeated disruptions (pandemic, war-related rerouting), supporting faster operational adjustments when conditions change.	Persistent dependence on fossil-fuel-based road freight and high exposure to energy-price volatility, increasing transition costs and risk.
Increasing alignment with EU-wide green–digital transformation agendas, creating a clearer direction for long-term modernisation of logistics processes and systems.	Infrastructure and technological readiness gaps across CEE countries (intermodal capacity, charging/refuelling networks, digital maturity), leading to uneven implementation capacity.
Growing relevance of resilience as a sector capability, which can be leveraged to integrate sustainability with continuity and risk management (sustainability as part of resilience).	Higher exposure to regulatory-compliance burdens relative to financial capacity (reporting, environmental standards), which may crowd out strategic investment planning.
Opportunities	Threats
EU policy emphasis on resilience and crisis preparedness supports the integration of sustainability with supply chain security and system robustness (resilience + decarbonisation).	Geopolitical instability and security shocks (including Russia's war against Ukraine) increase uncertainty, disrupt corridors, and shift priorities toward short-term continuity over long-term transformation.
Energy-security agenda and accelerated transition efforts create a policy and financing backdrop for efficiency and cleaner energy solutions, potentially supporting logistics decarbonisation through broader system changes.	Disruptions to maritime chokepoints and rerouting (Red Sea / Suez and related disruptions) raise transport costs, extend transit times and can increase emissions through longer routes, feeding inflationary pressures and operational volatility.
Rising demand for lower-carbon logistics services among EU supply chain partners can strengthen market incentives for measurable sustainability improvements, particularly for firms embedded in international value chains.	Implementation gap risk: transport remains the largest EU source of GHG emissions and recent assessments show limited progress, increasing the likelihood of tighter requirements that may outpace sector capabilities in CEE.
Potential to accelerate intermodal and digital solutions as a response to both decarbonisation and resilience needs, improving efficiency and transparency in logistics operations.	Competitiveness pressure: the need to maintain cost competitiveness under tighter environmental constraints may intensify tensions between compliance and investment capacity, particularly in more cost-sensitive CEE markets.

Source: own elaboration based on official EU strategy documents on sustainable and resilient mobility, energy-security policy materials, EEA indicators on transport emissions, and UNCTAD assessments of shipping route disruptions and supply-chain impacts

The TOWS analysis focuses on the relationship between the attributes of the logistics sector and macroeconomic/geopolitical factors, as presented in Table 3. The analysis finds that the relationship between the strength of the logistics sector and opportunities does not, in all instances, translate into the desired outcome for sustainability.

These factors encompass strategic position and operational flexibility, which fundamentally shape short-run resiliency. At the same time, limited investment potential and regulations may impede long-run development, which in fact relates more to operational threats than to transformational aspects of sustainability.

At the same time, the interactions between sector vulnerabilities and external pressures limit the sector's ability to respond effectively to increasing environmental and sectoral regulatory needs, resulting in ongoing trade-offs among environmental goals, safety, resilience, and economic competitiveness.

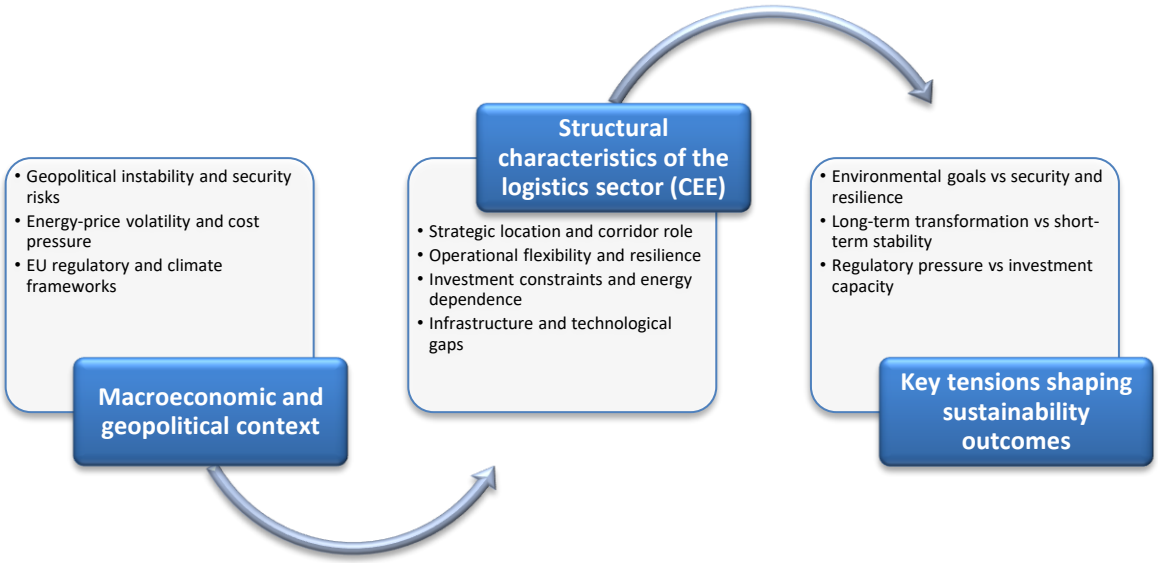
TABLE 3. TOWS ANALYSIS — KEY TENSIONS IN LOGISTICS SUSTAINABILITY IN CEE

TOWS intersection	Key tensions shaping sustainability in logistics (CEE)
S × O (Strengths × Opportunities)	The sector's strategic location and operational flexibility can support uptake of EU sustainable-mobility policies and resilience-oriented funding, but only if capacity to absorb EU funds and implement complex cross-border initiatives is strengthened.
S × T (Strengths × Threats)	While resilience and flexibility help maintain supply chains under stress (e.g., pandemic or geopolitical shocks), persistent instability (such as Russia's war in Ukraine and disrupted transport routes) forces firms to prioritise immediate operational continuity over longer-term sustainability investments.
W × O (Weaknesses × Opportunities)	Limited investment capacity and infrastructure gaps hinder ability to benefit from EU programmes promoting digitalisation and low-emission technologies; without improved institutional capacity, positive policy signals may not translate into actual adoption.
W × T (Weaknesses × Threats)	Infrastructure and technological readiness gaps, combined with exposure to rising regulations and operational cost pressures, can deepen vulnerability to economic and geopolitical shocks, reducing the feasibility of sustainable transitions. Geographic disparities in network density and modal balance further exacerbate this risk.

Source: own elaboration based on official EU transport policy trends and resilience initiatives (European Commission DG MOVE), transport resilience reports, and macro-regional logistics conditions

Chart 1 shows the results of the PESTEL, SWOT, and TOWS analyses. The chart highlights internal sector characteristics that shape sustainability results. Together, these interactions explain the emergence of persistent trade-offs between environmental goals, security, resilience, and economic competitiveness.

CHART 1. FRAMEWORK OF MACROECONOMIC AND GEOPOLITICAL INFLUENCES ON LOGISTICS SUSTAINABILITY IN CENTRAL AND EASTERN EUROPE



Source: own elaboration based on PESTEL, SWOT and TOWS analyses and official EU policy and institutional reports.

V. DISCUSSION

In the literature, sustainable development in logistics is most often analysed from the perspective of companies. Emphasis is placed on the role of managerial strategies, ecological innovations, and compliance with environmental regulations (Yoo, 2025; Bálint et al., 2025; Rohit et al., 2025). It is assumed that company decisions largely determine the pace and scope of the sector's transformation.

However, the results of this study show that this approach is insufficient in Central and Eastern Europe. Sustainable logistics development is determined by macroeconomic and geopolitical factors (Bellos et al., 2025; Chen et al., 2025; Zhao et al., 2025). As a result, even coherent strategies and declared environmental goals are not consistently implemented by companies.

The analyses confirm the central research hypothesis. Macroeconomic and geopolitical conditions primarily drive the sustainable development of the logistics sector in the CEE region (Bartosiewicz et al., 2025; Gniadkowska-Szymańska et al., 2025). Companies operate within constraints resulting from the economic and institutional situation, as well as energy and transport security.

In answering the research questions, it should be noted that macroeconomic instability, regulatory pressure, limited access to financing, and energy and transport security issues are key factors (Khalil et al., 2025; Kowalska & Misztal, 2025; Bellos et al., 2025). At the same time, it should be noted that a strategic location and operational flexibility support short-term adaptation (Peredy & Lakatos, 2025). However, they do not compensate for investment and infrastructure barriers, which limit the implementation of sustainable development.

The obtained results complement existing research on sustainable logistics. They shift the focus of analysis from the enterprise level to the macroeconomic environment (Comporek et al., 2022; Misztal et al., 2024). They show that in regions more susceptible to economic and geopolitical shocks, sustainable development depends on financial and institutional conditions, and is not solely the result of managerial decisions.

The results demonstrate that, on the one hand, policies aimed at enabling sustainable logistics services in CEE should address investment restrictions and the varying levels of infrastructure development (Bal & Vleugel, 2023; Bartosiewicz et al., 2025). Driving regulations may not be enough; financial support tools are required. Integrating environmental objectives with the objectives of sector security and stability is particularly important.

The main limitation of the study is its conceptual and qualitative nature. This does not allow for empirical verification of relationships or generalisations at the enterprise level. The analysis is based on secondary data, which does not always reflect the short-term responses of economic entities, especially in such a highly volatile environment.

Further research should focus on empirical analysis of the impact of macroeconomic conditions on the results of sustainable logistics development. Cross-regional comparisons within the European Union are also worthwhile. Another interesting direction is to deepen the analysis of the relationships between sustainability, resilience, and security in the logistics sector.

VI. CONCLUSIONS

This paper discussed logistics sustainability in Central and Eastern Europe from a macroeconomic and geopolitical viewpoint. The analysis shows that sustainability in logistics is powerfully created by external conditions rather than by firm-level strategies alone. While the study is conceptual, it provides a structured analytical framework that can support future empirical research on logistics sustainability under macroeconomic constraints.

Furthermore, the results indicate that macroeconomic volatility, prescriptive regulation, and geopolitical uncertainty constrain logistics firms' ability to pursue sustainability goals. This balancing of environmental goals with sector financial and energy security, resilience, and competitiveness is crucial here.

The study highlights the importance of expanding the scope of sustainability research in an enterprise context. In the context of Central and Eastern Europe, it may be conceived as a process within the defined economic circumstances.

The results support the consideration of regional limitations to support sustainable logistics-related policy measures. Regulatory measures need to be accompanied by investment support and infrastructure development to enable effective transformation.

This article contributes to the literature by offering a conceptual framework that integrates macroeconomic conditions into sustainability analysis in logistics sector. It provides a basis for further empirical research on the relationship between sustainability, resilience, and economic development in the logistics sector.

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